III. <u>REMARKS</u>

As an initial matter, the substitute specification filed on July 26, 2006 is missing pages due to a clerical error and is, therefore, incomplete. Filed herewith is a new substitute specification, which incorporates changes made by the substitute specification of July 26, 2006, and additionally amends the phrase "Japanese Unexamined Patent Application Publication No. 2004-233952" to --Japanese Unexamined Patent Application Publication No. 2004-100041-- in ¶ [0070] in order to correct an additional minor error found in the specification.

Claim 9 has been cancelled without prejudice. Claims 1-5, 8, 21, 23, 28-30, 38-41, 57, 82, 84, 86, 88, 90, 92, 96, 98, 100, 102, 104-117 have been amended, and new claim 140 has been added. Specifically, claim 1 has been amended to recite "wherein the copper alloy has a metal structure that contains α phase and one or more additional phases selected from the group consisting of (i) K phase, (ii) γ phase, (iii) K phase and γ phase, <u>(iv) β phase, and (v) μ phase</u>," which provides antecedent basis for the β and μ phases. Claim 1 has also been amended to recite "the copper alloy has an average grain diameter of 200 μm or less in a macrostructure <u>after the copper alloy has melted and solidified by casting</u>" as supported on page 11, lines 15-24, of Applicant's specification as originally filed. Furthermore, claim 1 has been amended to recite a "<u>casted</u> copper alloy" as supported on page 11, lines 15-24, of Applicant's specification as originally filed. Claims 2-5 and 28-30 have been amended in accordance with the amendment to independent claim 1. Claims 21, 23, 82, 84, 86, 88, 90, 92, 96, 98, 100, 102 and 104-117 have been amended to address a typographical error, which is an amendment that has no further limiting effect on the scope of the claims.

Claims 8 and 38-41 have been amended to recite "when melted and solidified during casting" as supported on page 11, lines 15-24, and page 12, lines 18-19, of Applicant's specification as originally filed.

New claim 140 incorporates subject matter from claims 1 and 9 and additionally recites "when melted and solidified during casting" as supported on page 11, lines 15-24, and page 12, lines 18-19, of Applicant's specification as originally filed. Claim 57 has been amended to depend upon new claim 140, which has no further limiting effect on the scope of claim 57.

The present amendment adds no new matter to the above-captioned application.

A. The Invention

The present invention pertains broadly to a casted copper alloy, such as may be used to make various products. In accordance with an embodiment of the present invention, a casted copper alloy is provided that has features recited by independent claim 1. In accordance with another embodiment of the present invention, a casted copper alloy is provided that has features recited by independent claim 140. Various other embodiments, in accordance with the present invention, are recited by the dependent claims.

An advantage provided by the various casted copper alloy embodiments of the present invention is that a casted Cu-Zn-Si alloy is provided that has significantly improved properties, such as castability, mechanical properties, corrosion resistance, machinability and/or workability.

B. The Rejections

Claims 1-139 stand rejected under 35 U.S.C. § 112, second paragraph, as indefinite.

Claims 1-9, 11-14, 16, 18, 20-25, 28-32, 34-41, 47-63, 69, 70, 73, 75, 76, 78, 82, 83, 92-108, 112-130 stand rejected under 35 U.S.C. § 103 as unpatentable over Parikh et al. (U.S. Patent 4,110,132, hereafter the "Parikh Patent") in view of Oishi (U.S. Patent Application Publication No. US 2002/0159912 A1, hereafter the "Oishi Publication"). Claim 10, 19, 42,

74, 77, 79, 80, 81 and 131-133 stand rejected under 35 U.S.C. § 103 as unpatentable over that Parikh Patent in view of the Oishi Publication, and further in view of Verhoeven (U.S. Patent 4,770,718, hereafter the "Verhoeven Patent"). Claims 15, 17, 6-68, 71, 71, 86-91 and 109-111 stand rejected under 35 U.S.C. § 103 as unpatentable over the Parikh Patent in view of the Oishi Publication, and further in view of Ohno (U.S. Patent 4,515,132, hereafter the "Ohno Patent"). Claims 134-139 stand rejected under 35 U.S.C. § 103 as unpatentable over the Parikh Patent in view of the Oishi Publication, and further in view of McDevitt (U.S. Patent 5,288,458, hereafter the "McDevitt Patent").

Applicant respectfully traverses the Examiner's rejections and requests reconsideration of the above-captioned application for the following reasons.

C. Applicant's Arguments

In view of the present amendment, claims 1-8 and 10-140 are now in compliance with 35 U.S.C. § 112, second paragraph.

i. The Section 103 Rejection

A prima facie case of obviousness requires a showing that the scope and content of the prior art teaches each and every element of the claimed invention, and that the prior art provides some teaching, suggestion or motivation, or other legitimate reason, for combining the references in the manner claimed. KSR International Co. v. Teleflex Inc., 127 S.Ct. 1727, 1739-41 (2007); In re Oetiker, 24 U.S.P.Q.2d 1443 (Fed. Cir. 1992). In this case, the Examiner has failed to establish a prima facie case of obviousness against Applicant's claimed invention because (i) the combination of the Parikh Patent, the Oishi Publication, the Verhoeven Patent, the Ohno Patent, and the McDevitt Patent, fails to teach, or suggest, each and every limitation of the claims, including independent claims 1 and 140, (ii) the Examiner has failed to

establish a legitimate reason for making the alleged combination of the disclosures, and (iii) the Examiner has failed to show that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicant's claimed invention if the combination of disclosures asserted by the Examiner was made.

ii. <u>The Parikh Patent</u>

The Parikh Patent discloses "copper based alloys" that have a stacking fault energy of less than 30 ergs per square centimeter, wherein the copper based alloy includes a first element selected from the group consisting of about 2 to 12% aluminum, preferably 2 to 10% aluminum, about 2 to 6% germanium, preferably 3 to 5% germanium, about 2 to 10% gallium, preferably 3 to 8% gallium, about 3 to 12% indium, preferably 4 to 10% indium, about 1 to 5% silicon, preferably 1.5 to 4% silicon, about 4 to 12% tin, preferably 4 to 10% tin, and about 8 to 37% zinc, preferably 15 to 37% zinc, and a balance comprising copper (Parikh Patent, col. 2, line 61, to col. 3, line 4). The Parikh Patent further discloses that the alloy may include at least one second element different from the first element, and selected from the group consisting of about 0.001 to 10% aluminum, about 0.001 to 4% germanium, about 0.001 to 8% gallium, about 0.001 to 10% indium, about 0.001 to 4% silicon, about 0.001 to 10% tin, about 0.001 to 37% zinc, about 0.001 to 25% nickel, about 0.001 to 0.4% phosphorus, about 0.001 to 5% iron, about 0.001 to 5% cobalt, about 0.001 to 5% zirconium, about 0.001 to 10% manganese and mixtures thereof (Parikh Patent, col. 3, lines 4-16).

The Parikh Patent further discloses that the alloying elements may undergo casting and hot rolling; however, the Parikh Patent clearly discloses that any cast alloy must be hot rolled to break up the cast structure and to obtain the desired gage for subsequent processing (Parikh Patent, col. 3, lines 35-40). The Parikh Patent is also completed silent regarding the

metal structure of the cast alloy. As admitted by the Examiner (Office Action, dated September 16, 2008, at 3, lines 17-18), the Parikh Patent does not teach, or suggest, (i) "the copper alloy has a metal structure that contains α phase and one or more additional phases selected from the group consisting of (i) K phase, (ii) γ phase, (iii) K phase and γ phase, (iv) β phase, and (v) μ phase" as recited by independent claims 1 and 140.

However, this is not the only deficiency in the disclosure of the Parikh Patent, which also does not teach, or even suggest, a cast alloy that (ii) "has an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting" as recited by claims 1 and 140. The Parikh Patent is completely silent regarding the grain size of cast copper alloy. In fact, the Parikh Patent discloses that in order to obtain a copper alloy that has a fine grain size of less than 0.015 mm, it is necessary to fully recrystallize the copper base alloy, which involves performing a recrystallization annealing step on copper alloy that has been previously cast and hot rolled, wherein the hot rolling is performed to break up the cast structure and the subsequent processing subjects the hot rolled alloy to a recrystallization anneal at a metal temperature of from 370°C to 600°C for at least 15 minutes, and generally for less than 24 hours (Parikh Patent, col. 3, lines 35-52). Therefore, any structure that the cast alloy had is not reasonably included in the recrystallized alloy of the Parikh Patent. The Parikh Patent further discloses that the fully recrystallized, fine grain material is then subjected to a critical cold working step utilizing at least 60% cold reduction (Parikh Patent, col. 4, lines 25-36).

As conceded by the Examiner (Office Action, dated September 16, 2008, at 4, lines 4-6; at 8, lines 8-9; at 13, lines 9-10; and at 19, lines 16-17), the Parikh Patent also fails to teach, or suggest, (iii) "additionally containing at least one component selected from Pb: 0.005 to 0.45 mass%, Bi: 0.005 to 0.45 mass%, Se: 0.03 to 0.45 mass%, and Te: 0.01 to 0.45 mass%" as recited by claim 2, and (iv) "the copper alloy comprises a dendrite network having

a divided crystalline structure" as recited by claim 10, (v) "horizontal continuous casting, upward casting or up-casting" as recited by claim 15, and (vi) "in a casting process, Zr is added in a form of a copper alloy material containing Zr" as recited by claim 134. However, the Parikh Patent also does not teach, or suggest, (vii) "a primary crystal is the α phase" as recited by claim 8.

With respect to previous claim 9 (which is now incorporated in independent claim 140), the Examiner contends that the limitation "wherein, when melted and solidified by casting, a peritectic reaction is generated" is an inherent feature of the copper alloy disclosed by the Parikh Patent because "Parikh teaches an annealing step at a high temperature followed by a cold reduction step" (Office Action, dated September 16, 2008, at 5, lines 6-9). The Examiner's inherency argument with respect to previous claim 9, and thus new claim 140, is improper and untenable, and must be withdrawn for the following reasons.

The Federal Circuit has held that a reference may inherently teach subject matter not explicitly disclosed by the reference when the disclosure is sufficient to show that the implicit subject matter is the natural result flowing from the explicitly disclosed subject matter. <u>Continental Can Co. USA Inc. v. Monsanto Co.</u>, 20 U.S.P.Q.2d 1746, 1749 (Fed. Cir. 1991). However, inherency cannot be established by mere probabilities or possibilities, and the mere fact that a certain thing may result from a given set of circumstances is insufficient. <u>Id</u>. The Federal Circuit has ruled that inherency is a question of fact. <u>In re Napier</u>, 34 U.S.P.Q.2d 1782, 1784 (Fed. Cir. 1995).

In this case, the Parikh Patent does not teach, or suggest, "when melted and solidified <u>during casting</u>, a peritectic reaction is generated" as recited by claim 140. Secondly, the Parikh Patent does not disclose sufficient facts from which a person of ordinary skill in the art could conclude that a "peritectic reaction" is the natural result, and not merely a possibility or a mere probability, of the process disclosed by Parikh. Thirdly, whether subsequent

recrystallization annealing followed by a critical cold reduction step involves a peritectic reaction is not relevant to whether a peritectic reaction is generated during casting. Fourthly, whether subsequent recrystallization annealing followed by a critical cold reduction step involves a peritectic reaction is not supported by sufficient facts to render such a peritectic reaction the natural result flowing from recrystallization annealing followed by a critical cold reduction step, and not just a mere possibility or probability. Fifthly, the Examiner speculates that it would be obvious to adjust temperature conditions of the recrystallization annealing step and/or the cold reduction step to generate a peritectic reaction (Office Action, dated September 16, 2008, at 5, lines 6-9); however, such speculation based on the unknown cannot establish a <u>prima facie</u> case of obviousness. See, e.g., <u>In re Newell</u>, 13 U.S.P.Q.2d 1248, 1250 (Fed. Cir. 1989)(Federal Circuit holding that "[o]bviousness cannot be predicated on what is unknown.").

For all of the above reasons, the Examiner's "inherency" argument regarding the "peritectic reaction" recited by claim 140 is untenable and must be withdrawn.

In sum, the Parikh Patent discloses a copper alloy that contains more than 10 selective elements so that a person of ordinary skill in the art would have to pick and choose to a degree such that **<u>undue experimentation would be required</u>**; therefore, the Parikh Patent is not valid prior art for the purpose of rendering Applicant's claimed invention unpatentable because it does not enable Applicant's claimed invention. See, e.g., <u>Impax Laboratories, Inc. v. Aventis Pharmaceuticals Inc.</u>, 545 F.3d 1312, 1314-15 (Fed. Cir. 2008).

Furthermore, the Parikh Patent pertains to a process of obtaining an improved combination of strength and bending characteristics for a cold-rolled copper alloy having low stacking-fault energy. The Parikh Patent discloses the combination of cold-rolling after recrystallization and finish annealing (Parikh Patent, col. 3, line 41, to col. 5, line 8). The value "R" for the rolling direction of 0, 45 and 90 degrees is used as an index (Parikh Patent,

col. 5, lines 15-35), which has no relevance to the subject matter of the present invention. The Parikh Patent also discloses that neither casting nor hot rolling is important to obtaining the desired copper alloy, and that after cold-rolling (not casting) the grain size is 0.015 mm (Parikh Patent, col. 3, lines 35-44).

iii. The Oishi Publication

The Oishi Publication discloses "copper/zinc alloys having low levels of lead and good machinability," which pertains to free-cutting copper alloy that comprises: (a) 69 to 79 percent, by weight, of copper, (b) 2.0 to 4.0 percent, by weight, of silicon, (c) 0.02 to 0.4, by weight, of lead, and (d) the remaining percent, by weight, of zinc (See Abstract of the Oishi Publication). The Oishi Publication further discloses that the copper alloy has a metal construction comprising multiple phases integrated to form a composite phase, wherein the composite phase is an α phase matrix having a total phase area comprising not more than 5% of β phase, and 5-70% of the total phase area is provided by at least one phase selected from the group consisting of a γ phase, a κ phase, and a μ phase (Oishi Publication, ¶ [0015]). However, the phase composition disclosed by Oishi is one obtained after hot extrusion (Oishi Publication, ¶¶ [0048] and [0052]), but not after casting.

As would be known by a person of ordinary skill in the art, alloys show various different phase compositions for hot extrusion alloy and for casting alloy due to the complicated changes of the alloy's state during these processes. Another distinguishing feature between the subject matter disclosed by the Oishi Publication and that of the present invention is that the present invention endeavors to improve castability and mechanical properties by grain refinement, whereas the Oishi Publication merely aims to improve machinability of a copper alloy.

From the above facts, a person of ordinary skill in the art would not be able to employ the hot extruded copper alloy disclosed by the Oishi Publication to create grains as small as 200 μm in the macrostructure of a casted alloy. In other words, the Oishi Publication does not teach, or even suggest, (i) a casted copper alloy...wherein the copper alloy has a metal structure that contains α phase and one or more additional phases selected from the group consisting of (i) K phase, (ii) γ phase, (iii) K phase and γ phase, (iv) β phase, and (v) μ phase" and (ii) "the copper alloy has an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting" as recited by independent claims 1 and 140.

As conceded by the Examiner (Office Action, dated September 16, 2008, at 8, lines 8-9; at 13, lines 9-10; and at 19, lines 16-17), the Oishi Publication also does not teach, or suggest, (iii) "a dendrite network" as recited by claim 10, (iv) "horizontal continuous casting, upward casting or up-casting" as recited by claim 15, and (v) "in a casting process, Zr is added in a form of a copper alloy material containing Zr" as recited by claim 134.

iv. The Verhoeven Patent

The Verhoeven Patent discloses a "method of preparing copper-dendritic composite alloys for mechanical reduction," wherein copper-dendritic composite alloys are prepared for mechanical reduction to increase tensile strength by (a) dispersing molten droplets of the composite alloy into an inert gas; (b) solidifying the droplets in the form of minute spheres or platelets; and (c) compacting a mass of the spheres or platelets into an integrated body (See Abstract of the Verhoeven Patent). The Verhoeven Patent discloses that the spheres preferably have diameters of from 50 to 2000 μm, and the platelets have thicknesses of 100 to 2000 μm, and that the spheres or platelets will contain ultra-fine dendrites that produce higher strengths on mechanical reduction of the bodies formed therefrom, or comparable strengths at

lower reduction values (See Abstract of the Verhoeven Patent). According to Verhoeven, the disclosed method is applicable to alloys of copper with vanadium, niobium, tantalum, chromium, molybdenum, tungsten, iron and cobalt (See Abstract of the Verhoeven Patent). The Verhoeven Patent does not teach, or even suggest, that its method for forming spheres or platelets that contain ultra-fine dendrites is applicable to Cu-Si-Zn alloys of the present invention.

In sum, the Verhoeven Patent discloses a method for forming droplets in the form of spheres generated in an argon gas, which later become a solid phase having the grain size of 50 to 2000 μm (Verhoeven Patent, Figure 3, col. 2, line 64, to col. 3, line 3, and col. 4, lines 53-63, and Abstract). However, the present invention is directed to the solid phase generated in the liquid phase, so the Verhoeven Patent is not technically relevant to the subject matter of the present invention. In other words, the Verhoeven Patent is non-analogous art. Similarly, dendrites formed in the gaseous phase, as disclosed by Verhoeven, should be differentiated from those formed in the liquid phase, as would be appreciated by a person of ordinary skill in the art.

In addition, the Voehoeven Patent discloses that alloy strength is improved by breaking dendrite arms, and that the method disclosed by the Voehoeven Patent is applicable to substantially different alloys (i.e., copper in combination with mainly vanadium, niobium, tantalum, chromium, molybdenum, tungsten, iron and cobalt) than those of the present invention.

v. The Ohno Patent

The Ohno Patent discloses "continuous metal casting," wherein molten metal is supplied into a mold having an inlet and an outlet opening in such a manner that the molten metal may have a substantially zero pressure at the outlet opening of the mold, while the

inner wall of the mold is maintained at a temperature sufficiently higher than the solidifying temperature of the molten metal so that the contiguous surface of the metal remains liquid until it has left the molten outlet, and a dummy bar having a temperature lower than the solidifying temperature of the molten metal is brought into contact with the molten metal at the outlet opening of the mold, and moved away from the outlet opening, whereby a solidified body of the metal is formed continuously on the end of the dummy bar (See Abstract of the Ohno Patent, and Figure 2). The Ohno Patent does not pertain to a Cu-Si-Zn alloy of the present invention and is, therefore, not relevant to the subject matter of the present invention.

vi. The McDevitt Patent

The McDevitt Patent discloses "machinable copper alloys having reduced lead content," which pertains to machinable alpha beta brass having a reduced lead concentration, wherein the alloy contains 1.5% to 5%, by weight, of bismuth to improve machinability (See Abstract of the McDevitt Patent, and col. 3, lines 39-49). The McDevitt Patent also discloses that either a portion of the zinc is replaced with aluminum, silicon or tin, or a portion of the copper is replaced with iron, nickel or manganese (See Abstract of the McDevitt Patent). The McDevitt Patent discloses that in order to form sulfides, tellurides and selenides in the alloy, zirconium may be added to the metal (McDevitt Patent, col. 6, lines 46-54).

In sum, the McDevitt Patent discloses a copper alloy containing 1.5-5.0%, by weight, of bismuth, instead of lead, to make the alloy machinable. The phase structure includes α and β phases, which is substantially different from the Cu-Si-Zn alloys of the present invention. Consequently, the subject matter disclosed by the McDevitt Patent is not useful for solving the problems address by the alloy of the present invention. For example, the Cu-Si-Zn alloy of the present invention includes some zirconium in order to refine grains and not for the

purpose of improving machinability. In fact, the Cu-Si-Zn alloy of the present invention has nothing to do with improving machinability by the addition of, for example, zirconium telluride and, therefore, derives no benefit from adding zirconium in the form of zirconium telluride.

vii. Summary of the Disclosures

The combination of the Parikh Patent, the Oishi Publication, the Ohno Patent and the McDevitt Patent still fails to teach, or even suggest, a casted copper alloy having (i) "a metal structure that contains α phase and one or more additional phases selected from the group consisting of (i) K phase, (ii) γ phase, (iii) K phase and γ phase, (iv) β phase, and (v) μ phase" and "an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting" as recited by independent claims 1 and 140. Furthermore, the Parikh Patent, the Oishi Publication, the Ohno Patent and the McDevitt Patent, either alone or in combination, also fail to teach, or suggest, (iii) "wherein, when melted and solidified by casting, a peritectic reaction is generated" as recited by claim 140, and (iv) "the copper alloy comprises a dendrite network having a divided crystalline structure" as recited by claim 10.

The present invention features fine grains, such as may be invisible to the naked eye, which are defined by the claims to have "an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting." The METALS HANDBOOK 629-631 (9^{th} Edition, Vol. 9, Metallography and Microstructures, American Society for Metals, filed herewith as "Exhibit A" and referred to hereafter as the "Metals Handbook") discloses a casting example with respect to an aluminum alloy. This aluminum alloy is one of the most noted alloys with respect to casting grain refinement when

titanium or titanium plus boron are added (Metals Handbook, at 630, right col., lines 1-4). Figures 7 to 9 of the Metals Handbook show the grain size in the macrostructure of the aluminum alloy before and after titanium and boron are added. As would be appreciated by a person of ordinary skill in the art, the grain size ranges from a few millimeters to several tens of millimeters (Figures 7 and 8) and from 0.3 mm to 1 mm (Figure 9).

On the other hand, Figure 1A of the above-captioned application shows grains in the macrostructure of casted alloy of the present invention that are generally too small to be apparent to the naked eye. Thus, the grain size exhibited by alloy of the present invention is even smaller than the smallest grain sizes of representative casted alloys of the prior art.

For all of the above reasons, the Examiner has failed to establish a prima facie case of obviousness against Applicant's claimed invention.

viii. No Legitimate Reason to Combine Disclosures

A proper rejection under Section 103 requires showing (1) that a person of ordinary skill in the art would have had a legitimate reason to attempt to make the composition or device, or to carry out the claimed process, and (2) that the person of ordinary skill in the art would have had a reasonable expectation of success in doing so. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007). In this case, the Examiner has failed to establish any legitimate reason to justify the combination of the Parikh Patent with one or more of the Oishi Publication, the Ohno Patent and the McDevitt Patent as discussed below.

First, the combination of the Parikh Patent, the Oishi Publication, the Ohno Patent and the McDevitt Patent falls short of teaching each and every limitation of independent claims 1 and 140. In particular, the Parikh Patent discloses that fine grains are obtained after hot rolling and recrystallizing a casted alloy (Parikh Patent, col. 3, lines 35-44). The Parikh

Patent does not teach, or suggest, that the casted alloy has fine grains of less than 0.015 mm. In fact, the Parikh Patent is completely silent regarding any grain characteristics of casted alloy, and neither the Oishi Publication, the Ohno Patent, nor the McDevitt Patent, make up this deficiency.

Second, the Parikh Patent is not enabling for a casted Cu-Si-Zn alloy that contains Zr, because the amount of picking and choosing required from the disclosure of the Parikh Patent would require undue experimentation to arrive at just the elemental composition of Applicant's claimed invention. After all of this non-obvious picking and choosing, and after optimizing compositional ranges as alleged by the Examiner, the choices alleged by the Examiner as "obvious" still fail to disclose a casted alloy with the recited grain diameter and the recited metal structure. As would be understood by a person of ordinary skill in the art, the Oishi Publication discloses metal structure of hot extruded alloy, and not casted alloy. Therefore, a person of ordinary skill in the art would have no legitimate reason to apply the hot extrusion techniques disclosed by the Oishi Publication to arrive at a casted alloy having a certain metal structure because formation of metal structure is a complex, multivariate phenomenon that depends on the manner in which the alloy is formed (i.e., hot extruded vs. casting).

Third, as discussed above, the <u>Verhoeven Patent is non-analogous art</u> because Verhoeven discloses a method for forming droplets in the form of spheres generated in an argon gas, which later become a solid phase having the grain size of 50 to 2000 μm (Verhoeven Patent, Figure 3, col. 2, line 64, to col. 3, line 3, and col. 4, lines 53-63, and Abstract). Thus, the Verhoeven Patent discloses dendrites formed in the gaseous phase but the present invention is directed to dendrites formed in the liquid phase. As would be instantly realized by a person of ordinary skill in the art, the Verhoeven Patent is therefore not even technically relevant to the subject matter of the present invention.

Fourth, the Verhoeven Patent discloses that its method of forming dendrites is applicable to alloys of copper with vanadium, niobium, tantalum, chromium, molybdenum, tungsten, iron and cobalt (See Abstract of the Verhoeven Patent). Consequently, a person of ordinary skill in the art would have no legitimate reason to apply the method disclosed by the Verhoeven Patent to form spheres or platelets of Cu-Si-Zn alloy merely hoping that they will contain ultra-fine dendrites.

With respect to the elemental composition of alloys, the mere addition of Zr and P is inadequate to achieve an alloy of the present invention because the blending proportions are important. In addition, the claimed average grain diameter of the grains can only be achieved when all of the other requirements (i.e., the compositional relationships and phase relationships as claimed resulting in the claimed metal structure after solidification) are fulfilled. Furthermore, the occurrence of the peritectic reaction when solidifying facilitates formation of the small grains of casted copper alloys of the present invention (See e.g., claim 140). No prior art literature teaches, or even suggests, the various limitations recited by Applicant's claims, and no prior art literature, or other non-literature source, would provide a person of ordinary skill in the art with a motivation, or any legitimate reason, to make the combination made by the inventor. Likewise, no specific embodiments are disclosed by any prior art literature that satisfies all of the limitations recited by Applicant's claims.

For all of the above reasons, the Examiner has failed to establish any legitimate reason for combining subject matter of the Parikh Patent with subject matter disclosed by one or more of the Oishi Publication, the Ohno Patent and the McDevitt Patent.

xi. No Reasonable Expectation of Success of Arriving at Applicant's Claimed Invention Even If the Combination of Parikh, Oishi, Ohno and McDevitt Was Made

A proper rejection under Section 103 requires showing that a person of ordinary skill in the art would have had a reasonable expectation of success in making Applicant's claimed invention if the combination asserted to be obvious was made. PharmaStem Therapeutics, Inc. v. ViaCell, Inc., 491 F.3d 1342, 1360 (Fed. Cir. 2007). In this case, the Examiner has failed to demonstrate that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicant's claimed invention even if the combination of the Parikh Patent with one or more of the Oishi Publication, the Ohno Patent and the McDevitt Patent is made.

Specifically, the combination of the Parikh Patent, the Oishi Publication, the Ohno Patent and the McDevitt Patent falls short of teaching each and every limitation of independent claims 1 and 140 because the combination does not achieve a casted copper alloy having "an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting." As discussed above, the Parikh Patent discloses that fine grains are obtained after hot rolling and recrystallizing a casted alloy (Parikh Patent, col. 3, lines 35-44), but the Parikh Patent does not teach, or suggest, that the casted alloy itself has fine grains of less than 0.015 mm. In fact, the Parikh Patent is completely silent regarding any grain characteristics of casted alloy, and the Parikh Patent discloses that the hot rolling step breaks up the structure of the casted alloy so a person of ordinary skill in the art would not expect the grain structure of the casted alloy to be observed in Parikh's alloy following recrystallization annealing. Furthermore, neither the Oishi Publication, the Ohno Patent, nor the McDevitt Patent, make up these shortcomings in the disclosure of the Parikh Patent. Therefore, a person of ordinary skill in the art would have had no reasonable expectation of success of arriving at a casted copper alloy having "an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been

melted and solidified by casting" even if the combination of Parikh, Oishi, Ohno and McDevitt was made.

Second, the Parikh Patent is not enabling for a casted Cu-Si-Zn alloy that contains Zr, because the amount of picking and choosing required from the disclosure of the Parikh Patent would require undue experimentation to arrive at just the elemental composition of Applicant's claimed invention. After all of this non-obvious picking and choosing, and after optimizing compositional ranges alleged by the Examiner, the choices alleged by the Examiner as "obvious" still fail to disclose a casted alloy with the recited grain diameter and the recited metal structure. As would be understood by a person of ordinary skill in the art, the Oishi Publication discloses metal structure of hot extruded alloy, and not casted alloy. Therefore, a person of ordinary skill in the art would have had absolutely no expectation of successfully arriving at a casted copper alloy having the average grain diameter recited by independent claims 1 and 140 even if the combination of Parikh, Oishi, Ohno and McDevitt was made.

Third, as discussed above, the Verhoeven Patent discloses a method for forming droplets in the form of spheres generated in an argon gas, which later become a solid phase having the grain size of 50 to 2000 μm (Verhoeven Patent, Figure 3, col. 2, line 64, to col. 3, line 3, and col. 4, lines 53-63, and Abstract) so that the Verhoeven Patent discloses dendrite formation in the gaseous phase. Furthermore, the Verhoeven Patent discloses that its method of forming dendrites is applicable to alloys of copper with vanadium, niobium, tantalum, chromium, molybdenum, tungsten, iron and cobalt (See Abstract of the Verhoeven Patent). The present invention, on the other hand, involves formation of dendrites in the liquid phase and pertains to Cu-Si-Zn alloy. Consequently, a person of ordinary skill in the art would have had no reasonable expectation of success of arriving at a casted copper alloy having a "dendrite network" as recited by claim 10 when combining Verhoeven's method with the

subject matter of Parikh Patent, or with any other combination of the Parikh Patent, the Oishi Publication and/or the McDevitt Patent.

With respect to the elemental composition of alloys, the mere addition of Zr and P is inadequate to achieve an alloy of the present invention because the blending proportions are important. In addition, the claimed average grain diameter of the grains can only be achieved when all of the other requirements (i.e., the compositional relationships and phase relationships as claimed resulting in the claimed metal structure after solidification) are fulfilled. Furthermore, the occurrence of the peritectic reaction when solidifying facilitates formation of the small grains of casted copper alloys of the present invention (See e.g., claim 140). No prior art literature teaches, or even suggests, the various limitations recited by Applicant's claims, and no prior art literature, or other non-literature source, would provide a person of ordinary skill in the art with a reasonable expectation of success with respect to making the combination made by the inventor. Likewise, no specific embodiments are disclosed by any prior art literature that satisfies all of the limitations recited by Applicant's claims.

For all of the above reasons, the Examiner has failed to demonstrate that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicant's claimed invention even assuming *arguendo* (which is an invalid assumption) that the Examiner had established a legitimate reason to combine the Parikh Patent with subject matter disclosed by one or more of the Oishi Publication, the Ohno Patent and the McDevitt Patent.

x. Evidence of Superior and Unexpected Results

When an applicant adduces specific data demonstrating substantially improved results, and states that the results are unexpected, then in the absence of evidence to the

contrary, applicant has established unexpected results sufficient to prove the invention is nonobvious. In re Soni, 34 U.S.P.Q.2d 1684, 1687-88 (Fed. Cir. 1995). In this case, Figure 1A, and page 11, lines 15-24, and page 47, lines 2-10, of Applicant's disclosure as originally filed shows that Cu-Si-Zn alloy of the present invention has an average grain diameter of 200 μm or less in the macrostructure after the copper alloy has been melted and solidified by casting. On the other hand, the Metals Handbook demonstrates that a well-known casting example with respect to an aluminum alloy, which Applicant contends is generally representative of the finely grained castings of the prior art, shows in Figures 7 to 9 that the grain size in the macrostructure of conventional casted alloy has a grain size ranging from a few millimeters to several tens of millimeters (Figures 7 and 8) and 0.3 mm to 1 mm (Figure 9).

In other words, the substantially smaller average grain size achieved by Cu-Si-Zn alloy of the present invention over finely grained casted alloy of the prior art is a wholly unexpected result. Consequently, even assuming *arguendo* that the Examiner had established a prima facie case of obviousness against Applicant's claimed invention (which is an invalid assumption), the substantially smaller average grain diameter achieved by the present invention alloys over small grain casted alloys of the prior art is sufficient to overcome the alleged prima facie case.

IV. CONCLUSION

In view of the present amendment, claims 1-8 and 10-140 are in compliance with 35 U.S.C. § 140. Furthermore, the Examiner has failed to establish a prima facie case of obviousness against independent claims 1 and 140 because (a) the combination of the Parikh Patent, the Oishi Publication, the Ohno Patent and the McDevitt Patent fails to teach, or suggest, (i) a "casted copper alloy" having "a metal structure that contains α phase and one or

more additional phases selected from the group consisting of (i) K phase, (ii) γ phase, (iii) K phase and γ phase, (iv) β phase, and (v) μ phase" and (ii) "an average grain diameter of 200 μm or less in a macrostructure after the copper alloy has been melted and solidified by casting" as recited by independent claims 1 and 140, (b) the Examiner has failed to establish a legitimate reason for making the alleged combination of the disclosures, and (c) the Examiner has failed to show that a person of ordinary skill in the art would have had a reasonable expectation of success of arriving at Applicant's claimed invention if the combination of disclosures asserted by the Examiner was made.

Furthermore, even assuming the Examiner had established a prima facie case of obviousness (which is an invalid assumption), Applicant has adduced specific evidence of substantially superior and unexpected reduction in fine grain diameter of casted alloy of the present invention over casted alloy of the prior art.

For all of the above reasons, claims 1-8 and 10-140 are in condition for allowance, and a prompt notice of allowance is earnestly solicited.

The below-signed attorney for Applicant welcomes any questions.

Respectfully submitted,

GRIFFIN & SZIPL, P.C.

Joerg-Uwe Szipl
Registration No. 31,799

GRIFFIN & SZIPL, P.C.
Suite PH-1
2300 Ninth Street, South
Arlington, VA 22204
Telephone: (703) 979-5700
Facsimile: (703) 979-7429
Email: GandS@szipl.com
Customer No.: 24203